concrete construction

JUNE 1958 VOL. 3, NO. 6

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5 **CURING METHODS AND MATERIALS**

Proper curing is always one of the most important considerations in concrete work, but it takes on even greater significance in hot weather when dry winds can quickly evaporate the water which is essential to full strength development. Here are some things you should know about the methods and materials commonly used to create favorable curing conditions.

10 **TROUBLES UNDER THE SUN**

Despite all you may have heard to the contrary, there's probably more likelihood of encountering serious trouble with concrete work in summer than in winter. This article tells you why and offers some simple rules for avoiding the ill effects of hot weather.

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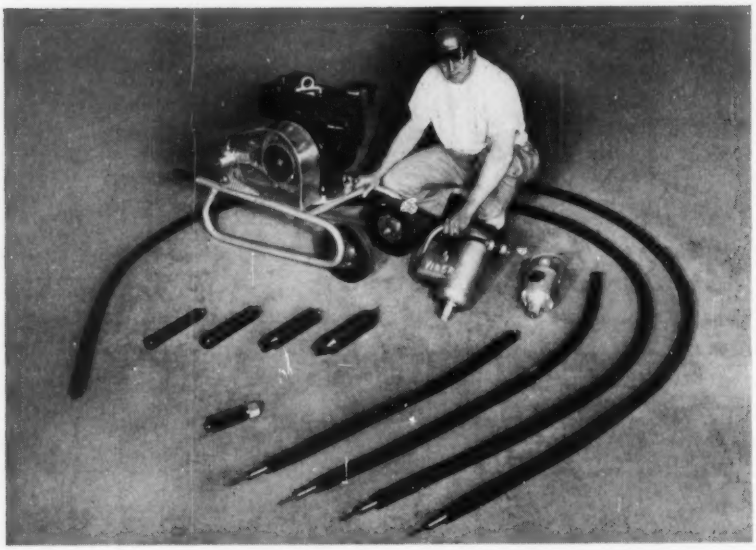

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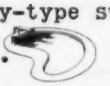
...with Gates Systems. There's a fast, low-cost Gates System for every forming job...from high-speed project work, to multiple-story commercial buildings where the low bid counts ...from tricky battered walls and radius walls where true curved surfaces are a necessity, to complex, luxury-type swimming pools. 

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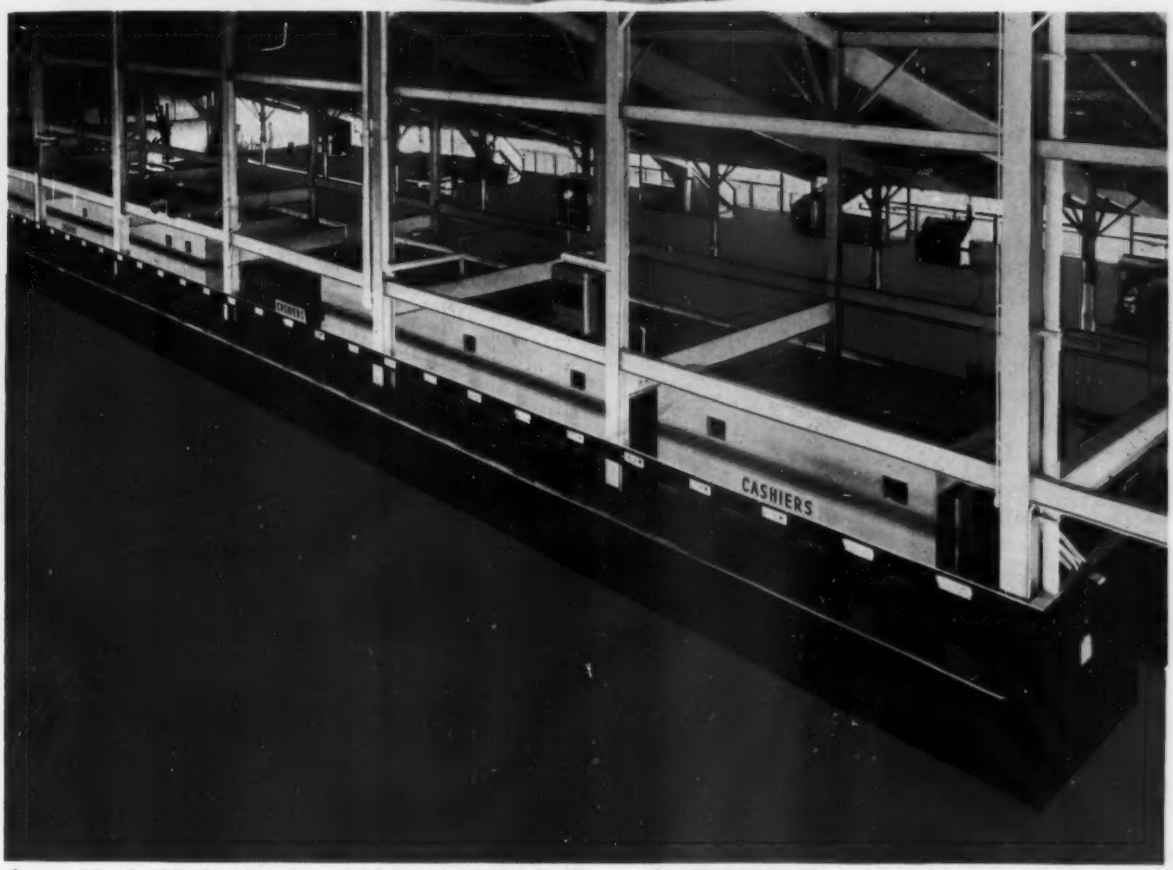

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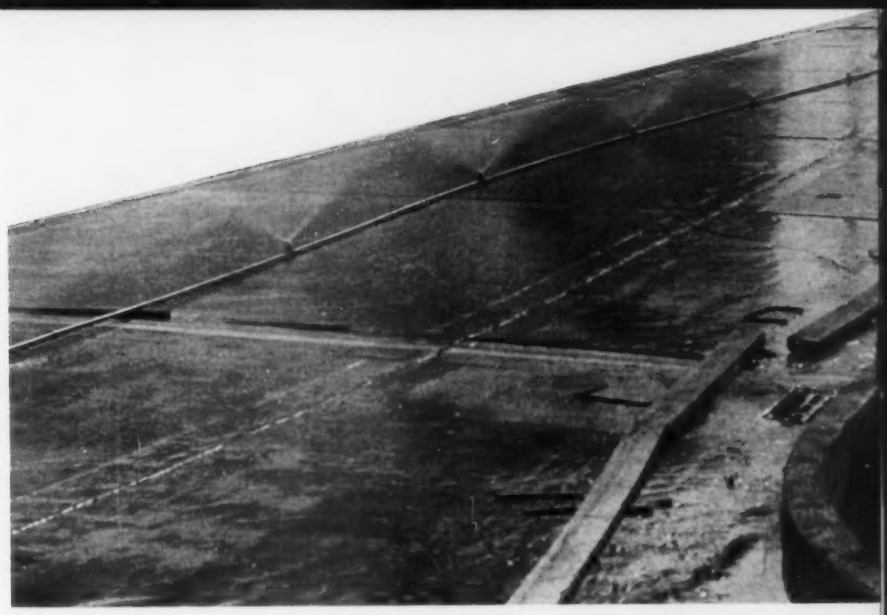


Spraying is among the more effective methods of curing concrete whenever a sufficient quantity of water at high pressure is available. In this view a city street pavement is being cured with water forced through spray nozzles located in the pipe extending down the center of the pavement. The chief objection to this method is its high cost.

Surveying the many . . .

CURING METHODS AND MATERIALS

IT WOULD BE DIFFICULT to overemphasize the importance of curing in concrete construction. On it hinges to a great extent concrete's watertightness, hardness, durability and strength. As a matter of fact, curing is the most important single factor in achieving high strengths. Essentially, curing is simply a means of assuring thorough hydration of the cement paste.

Studies have shown that the amount of water needed for cement hydration is always less than that needed to render a mix workable. Therefore, effective curing boils down to a matter of providing a moisture barrier to prevent evaporation of the mix water. The several methods of preventing dehydration of concrete vary appreciably in their efficiency and in the time when they can be employed. The following is a short survey of curing methods with a few comments on the characteristics of each type.

WATER

Most effective of all the known curing materials is water. Most effective, that is, in terms of preventing evaporation of the mix water. In actual practice, use of water by itself as a curing method poses a number of problems.

Two curing methods use water as their sole agents: fogging or spraying and ponding. In spraying, water is forced through horizontal pipes to various locations and out through nozzles which disperse it over the concrete surface. Fogging is essentially the same procedure with the exception that the nozzles produce a mist-like effect rather than a concentrated spray. In addition to their high cost, these methods are subject to several vagaries—water pressure, wind velocity, pipe leakage and nozzle clogging.

Earth dikes are set up around the perimeter of a slab in ponding and a pond of water is pumped over the concrete. Although highly efficient in preventing evaporation, ponding is messy and imposes a considerable load on structural slabs (those other than slab-on-ground).

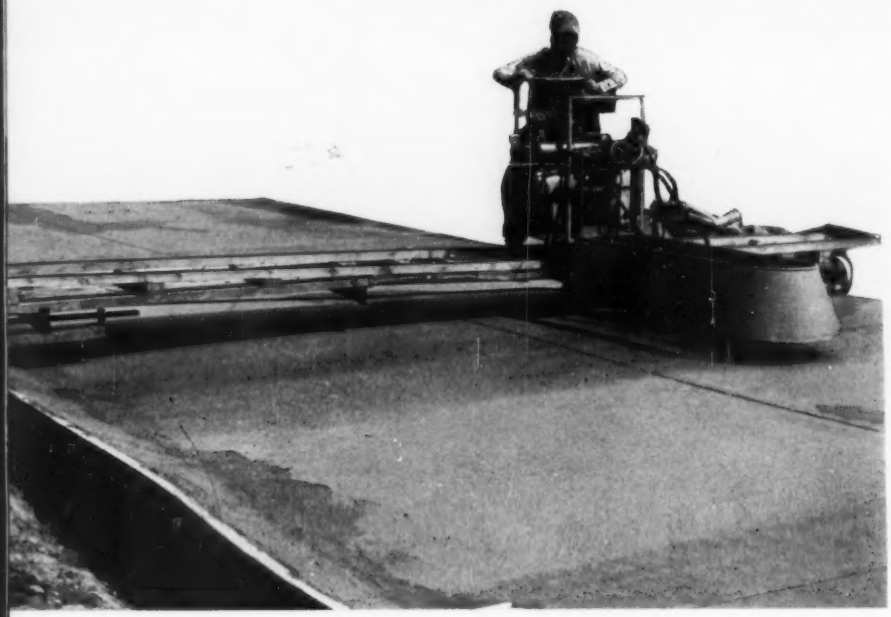
Both of these methods require considerable quantities of water, need careful supervision and are applicable only to horizontal surfaces. Although they were once considerably in vogue (ponding especially found wide application), the rise in wages and materials costs have gradually rendered them less and less practical. The prime uses of ponding today are in farm construction and do-it-yourself projects.

A number of improvements have been made in burlaps in recent years to adapt this material more specifically for the job of curing concrete. The improved materials are easier to handle, often have good light reflectance, and are fire- and rot-resistant.

BURLAP

Not too long ago the accepted standard for curing was ponding for primary use (before the concrete had hardened) and saturated burlap for secondary curing. The tarpaulins were positioned to cover the entire surface area and then sprayed with water and kept wet throughout the curing period.

For a while burlap was eclipsed by



The machine in this picture is being used to spray a membrane curing compound over a just-finished concrete pavement. White compounds are considered best for hot weather concreting because their reflectance helps reduce the temperature of the concrete.

some of the then newly-developed methods—sprayed membranes, plastic sheets, paper, etc.—but in recent years it has made a strong bid for a comeback through a number of improvements. Treatments with plastics, aluminum and other materials have improved its handling qualities, even in cold weather; increased its light reflectance; curtailed rot; and greatly increased its fire resistance. When repeated use is important the new tarpaulins often prove of value.

MEMBRANE COMPOUNDS

Membrane compounds have become popular curing aids due to their ease of application. When a concrete area is completely sprayed with one of these products it is effectively sealed and evaporation is greatly retarded. Membrane compounds are commonly available in three forms: clear, black and white.

Clear compounds are used on surfaces that must be architecturally attractive—exposed walls, ceilings, stairways and the like. Often a dye is added to help assure complete coverage of the concrete. This color fades within a few days leaving a transparent film.

Black compounds are manufactured with an asphaltic base. Because of their viscosity, dark color and freedom from pin holes, they provide an especially effective moisture barrier. This type is used in two-course basement floor slabs for waterproofing and is also effective on slabs that are to be covered with tile or linoleum. It has the disadvantage of a high heat absorption rate when compared with white compounds.

White compounds are especially useful in hot weather concreting since they reflect most of the heat rays, thereby reducing the concrete's temperature. This temperature reduction further minimizes evaporation and increases strengths. White compounds should be thoroughly mixed before spraying since the pigment used for coloring tends to settle out. Often a gray-colored compound is available for use where a natural concrete shade is desired or when the glare of a white surface would be objectionable.

Most manufacturers of these materials recommend that they be applied at a rate of approximately one gallon per 200 square feet per coat and that two coats be used. Even using two coats they are impressively low cost. Membrane compounds can be applied with hand or power sprays or by automatic self-powered sprayers on large projects. Some trouble was experienced in the early history of these compounds with caking of the material and subsequent clogging of the lines and spray nozzles. Since then, however, dispersing agents have been developed that have largely ended this complication.

PAPER

A number of waterproof papers have come on the market in the last decade and found wide use. One of their important advantages is that they do not require periodic additions of water; they assure proper hydration by furnishing a moisture barrier, thereby preventing evaporation. Since water is continuously available, curing proceeds uniformly and the danger of improper curing from a breakdown in water supply is eliminated.

Waterproof curing papers also make it simple to check on the progress of curing and the condition of the slab. This is especially true if sand is used to anchor the paper edges. Manufacturers recommend that their paper overlap several inches where sheets butt and be secured with sand, non-staining mastic, glue, or masking or pressure-sensitive tape. Wood planks should be used where areas are to be subject to heavy traffic. Curing papers also offer some protection against damage from frost, direct sun, traffic, mortar staining and debris. Also clean-up is fast and easy.

Ways have been devised to reinforce curing papers to lengthen their usable life. One of the methods employs a tri-directional pattern of glass fibers placed between layers of kraft paper. These types retain considerable strength even when wet. Consequently they can be moved with greater ease and be reused several times. Some papers are pre-shrunk to prevent exposing portions of the concrete.

Curing papers are usually available from stock in widths from 18 to 96 inches; and some firms offer giant sizes, up to 26-feet wide, on special order. For slabs and structural concrete of relatively simple shapes, curing papers offer a low-cost and efficient means of curing.

PLASTIC SHEETS

A valuable addition to the list of curing materials has been plastic sheeting. These lightweight, effective moisture barriers are flexible tools in securing high-quality concrete. Although higher in first cost than most curing papers, they are easy to fit over even complex shapes. In highway work, no cutting is required on curved pavements. In addition, these sheets weigh as little as 20 pounds for enough material to cover 1,000 square feet of concrete.

Plastic sheeting is non-absorptive.

It therefore resists rotting and mildew and the weight is constant dry or wet. It can be easily rolled up for reuse after controlled curing is completed; over twenty reuses have been reported with these materials. Plastic sheets need not be idle between curing applications, either. They find wide use for such jobs as protection for lumber and other materials affected by weather, for glazing windows, for walling temporary storage buildings and, when backed by paper, for lining wooden forms to achieve an especially smooth concrete surface.

Widths up to 32 feet are available in plastic sheeting. Even the largest sizes require little manpower to handle thanks to their lightweight and non-absorptive characteristics. The durability of this material depends to a great extent upon its thickness. Sheets are manufactured in thicknesses ranging upwards from four mils (.004 inch). A white pigment is usually added to render these sheets more effective in keeping concrete temperatures low.

ODDS AND ENDS

Over the years a considerable amount of improvising has been done in connection with the curing of concrete. Many improvisations have fallen by the wayside as being impractical or ineffective, some have been replaced

ABOVE: A number of reinforced waterproof papers are now on the market for curing concrete and are finding increased acceptance. Their function is to provide a moisture barrier which prevents the evaporation of the water in the concrete. This method eliminates the always serious danger of an interruption in water supply.

BELOW: Effective curing of the floor slabs in this housing development has been assured by covering the freshly placed concrete with polyethylene film, a non-absorbtive plastic sheeting material. These and other sheet materials can be rolled up after each job and stored for re-use later or used in many other ways at the construction site.

by more efficient methods, and others are relegated to use only under unusual circumstances.

Wet earth and sand were found to be expensive in manpower and messy in use. Straw and hay, although sometimes used for small farm projects, have proven mediocre curing materials; other products have largely replaced them in this field. Cotton mats have largely dropped from the picture due to problems of bulk, weight, expense and water absorption. Wet sawdust, in addition to its drawbacks in handling and clean-up, occasionally retarded hardening of the concrete through the action of sugar in the sap. Even electronics has made a bid in this field. Experiments in Japan with electrical curing in cold weather through the use of electrodes in the concrete have shown that this might be an effective method for certain conditions.

Our discussion has centered around methods and materials. Naturally, there are a number of other variables which influence the success of curing. These include subgrade composition and condition, concrete temperature, cement types, length of controlled curing and thermal shock. Also job conditions must be carefully considered when choosing a curing method. For example, in resurfacing work, a curing material which offers a great deal of thermal insulation as well as moisture retention would be highly desirable to prevent differential thermal movement of the base slab and the topping layer.

Enlightened practices and modern materials have reduced to three days the curing period which consumed 28 days in the "good old days." Improvements in ease of use and efficiency together with reductions in costs are a continuing job for both materials manufacturers and concrete contractors. As new ideas come to the fore CONCRETE CONSTRUCTION will report them promptly. END

Readers who would like to have additional information on the subject discussed in the foregoing article may request it by filling out one of the reader service cards in this issue.

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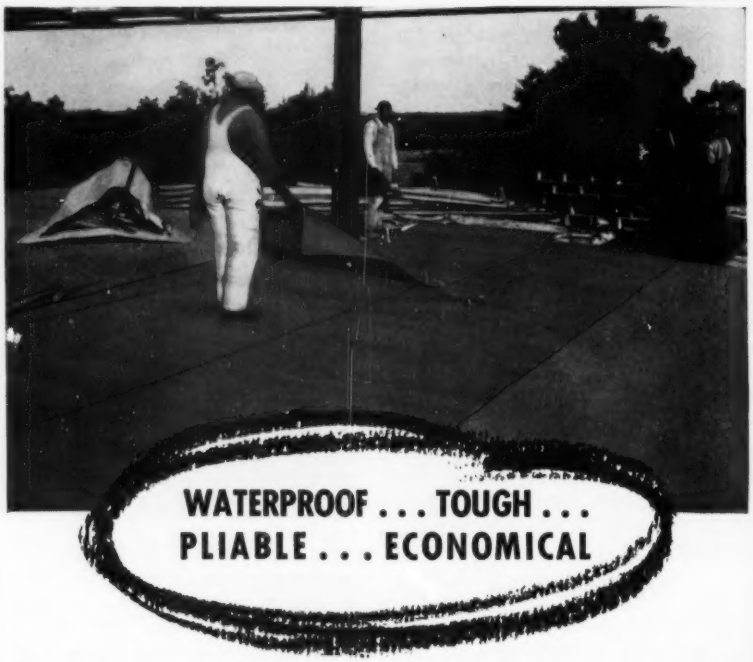

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Hot-weather concreting

calls for some precautions

TROUBLES UNDER THE SUN

FILE: SUMMER CONCRETING

COLD-WEATHER CONCRETING poses problems that are generally recognized in the field because there's no escaping them. It's easy to see that a pour that has frozen is a loss. The results of poor practices in hot-weather concreting are far more insidious and often more serious. A frozen floor slab must usually be torn up and replaced with a good one; a floor slab damaged by high temperatures and low humidity will generally be left to bear mute but eloquent testimony to poor workmanship.

When are hot-weather precautions necessary? This is a tough question to answer since it depends upon several factors — air temperature, humidity, wind velocity, exposure to sun, temperature of materials and curing conditions. Usually it's time to take precautions when the temperature reaches 85 degrees or more. If the air is dry and/or a wind is blowing, the need for and extent of precautionary measures is greatly increased.

EFFECT OF HEAT

First off, let's examine the reaction of concrete to summer conditions. Concrete hardens in relation to its temperature—the higher the temperature, the faster concrete hardens. Also, as temperatures rise more water is needed to make concrete workable.

Tests conducted at the University of Maryland have indicated that concrete mixed at 100 degrees requires about three more gallons of water per cubic yard to maintain the same consistency

as concrete mixed at 73 degrees. This extra water results in a loss of 300 psi in 28-day strength. In addition, finishing is often rushed to completion because the concrete hardens so quickly. On floor jobs, the result is a poor wearing surface, especially since slabs tend to bleed more freely in summer. This brings to the surface organic material and fines in the mix, with a further reduction in wearing qualities.

There is a strength loss in hot weather even when no extra water is added to the mix. As stated in the Bureau of Reclamation's *Concrete Manual*, an 800 psi 90-day strength loss is experienced when concrete is mixed at 100 degrees compared with the same concrete mixed at 40 degrees. As can be seen, the properties of concrete are markedly and adversely affected by hot-water mixing and placing.

However, whereas careful cold-weather concreting often incurs expensive equipment, success in summer work most often depends mainly upon careful workmanship. Let's consider a few of the problems frequently encountered.

ORDERING CONCRETE

High temperatures have their greatest immediate effect on the consistency or slump of concrete. As shown in the accompanying table, more water is needed to maintain the same slump as the mix temperature rises. Therefore, a slump test without consideration of the season can be misleading.

When ordering summer concrete, remember this dual loss—in strength and slump—and redesign your mix accordingly to achieve a workable consistency with the required strength.

An average mix is composed volumewise of about 70 percent aggregates, 20 percent water and 10 percent cement. According to a recent recommended practice compiled by Emil Schmid and the Sika Chemical Corp., the temperature of an ordinary concrete mix will be raised one degree

TABLE 1. Shown here are data from tests in which water-cement ratio and amount of entrained air were maintained constant. Type I, II and III cements were used. These tests show that the slump decreases as the temperature of the fresh concrete increases, and that the compressive and flexural strengths decrease, particularly at later ages, as the initial concrete temperatures increase. These reductions in strength would have been even greater if the water-cement ratio had been increased to maintain the same slump.

TABLE 1: EFFECT OF INITIAL CONCRETE TEMPERATURE ON COMPRESSIVE AND FLEXURAL STRENGTHS

CEMENT CONTENT: 5½ sacks per cu. yd.
AIR-ENTRAINMENT: Agent added to maintain an air content of 4½% ±½%.
CURING: Specimens made at 73°F. were cured continuously moist at 73°F. Those fabricated at higher temperatures were moist-cured 7 days at the higher temperature and then moist-cured at 73°F. until age of test.

Initial Temperature (deg.F.)	Slump (in.)	Compressive Strength (lb. per sq. in.)			Flexural Strength (lb. per sq. in.)		
		7 days	28 days	90 days	7 days	28 days	90 days
Type I Portland Cement—W/C = 5.1 gal per sack							
73	3.4	4060(100)*	5440(100)	6000(100)	530(100)	675(100)	780(100)
90	3.1	4160(103)	4820(88)	5460(91)	520(98)	610(90)	705(90)
105	1.9	3850(95)	4200(77)	4920(82)	505(95)	600(89)	640(82)
120	1.3	3440(84)	4080(75)	4320(72)	450(85)	550(82)	570(73)
Type II Portland Cement—W/C = 4.9 gal per sack							
73	3.6	3680(100)	5230(100)	6570(100)	490(100)	635(100)	740(100)
90	3.2	3900(106)	5190(99)	6090(93)	540(110)	645(102)	740(100)
105	2.3	4420(120)	4990(95)	5760(88)	515(105)	650(102)	720(97)
120	1.2	3930(107)	4720(90)	5300(81)	480(98)	605(95)	610(82)
Type III Portland Cement—W/C = 5.6 gal per sack							
73	3.2	4610(100)	5460(100)	5970(100)	515(100)	600(100)	725(100)
90	3.2	5010(109)	5610(103)	5940(100)	545(106)	660(110)	660(91)
105	3.1	4580(99)	5210(96)	5300(89)	465(90)	575(96)	610(84)
120	2.2	4160(90)	4490(82)	5000(84)	485(94)	575(96)	610(84)

*Values in parentheses are percentages of strengths of concretes mixed and cured continuously at 73°F.

if the temperature of the cement is raised nine degrees, the water is raised 3.6 degrees or the aggregate temperature rises only 1.6 degrees.

It is easily seen that it is in control of the aggregate and water temperatures that the greatest temperature reduction of the mix will be achieved. Many ready mix plants keep their aggregate piles sprinkled and use cool water to assure that concrete is delivered within the desirable 70-80 degree range. Often, when conditions warrant, ready mix can be supplied with crushed ice as part or all of the water. Of course, the ice must be melted before the concrete is placed.

BEFORE POURING

The most that can be expected of a ready mix supplier is that he will deliver the specified mix at the correct time and temperature. After that it's up to the men on the job to handle the concrete in a manner that will assure good results.

High temperatures accelerate the rate of hardening of concrete and also promote rapid evaporation of the mix water, especially in slabs where surface area is great compared with volume. Prolonged mixing increases the concrete's temperature due to friction of the aggregate and the heat in the drum. It is imperative, therefore, that the concrete be discharged, preferably in its final location, as soon as it is delivered to the job site.

This means that forms have been set in place, all tools and materials are ready, and enough workmen are on hand to pour and finish the concrete quickly. An important part of the preparatory measures is dampening the subgrade. This is best accomplished by thoroughly soaking it the night before pouring, and then sprinkling it shortly before the concrete is poured. If the subgrade is not wetted, it is likely that plastic shrinkage will develop. The dry subgrade absorbs water from the mix and causes cracks to form at the top surface. An extensive discussion of this problem can be found in CONCRETE CONSTRUCTION, *September 1956, pages 8-9.*

A dry subgrade, high concrete temperature, long mixing, the use of accelerating admixtures, and the heavy demands placed upon cement manufacturers in the mild seasons are common causes for premature set, wherein concrete sets up before it can be properly poured and finished. Careful use of a water-reducing and retarding agent has often proved helpful in preventing this complication.

This is probably as good a place as any to clear up some confusion that exists regarding two forms of premature hardening—false set and flash set. False set is a reversible phenomenon that is the less serious of the two. Gypsum is added to cement to control its setting time, specifically to

TABLE 2: EFFECT OF HOT CEMENT ON PROPERTIES OF CONCRETE

PORTLAND CEMENT: Type I
CEMENT CONTENT: 5½ sacks per cu. yd.
NET W/C RATIO: 4.85 gal. per sack of cement.
AIR-ENTRAINMENT: Agent added to maintain an air content of 4½% ±½%.
CURING: Specimens made at 73°F. were cured continuously moist at 73°F. Those fabricated at 105°F. were moist-cured 7 days at 105°F., followed by 21 days moist curing at 73°F.

Mix No.	Temp. of Materials (deg. F.)			Temp. of Concrete (deg. F.)	Slump (in.)	Concrete Strength (lb. per sq. in.)			
	Cement	Water	Aggregate			Flexural		Compressive	
						7 days	28 days	7 days	28 days
1	74	73	74	76	3.5	550	685	4730	6230
2	148	44	74	76	3.2	545	650	4560	5950
3	179	33	74	76	2.7	550	655	4650	5960
4	74	124	101	108	0.6	555	610	4500	5060
5	149	60	104	102	0.7	535	635	4600	5190
6	174	50	104	102	1.0	535	640	4540	5090

TABLE 2. The use of hot cement, which has high temperatures as a result of the clinker-grinding process, is sometimes cited as the possible cause for concreting difficulties. Tests show that hot cement has no significant effect on the slump or on compressive and flexural strengths when the temperature of the freshly-mixed concrete is maintained constant. Cement having temperatures of approximately 74 degrees F., 150 degrees F. and 175 degrees F. was used and the temperatures of the mixing water and the aggregates were adjusted to secure, as nearly as possible, temperatures of 73 degrees F. and 105 degrees F. in the freshly-mixed concrete. The results show that increasing the temperature of the concrete reduced the slump and decreased the 28-day compressive and flexural strengths, but at a given concrete temperature, results show that the temperature of the cement had no effect.

retard it. Its chemical formula is: $CaSO_4 \cdot 2H_2O$. If high cement temperatures (over 180 degrees) cause much of the water (H_2O) to become chemically removed, the compound can change to: $CaSO_4 \cdot 1/2H_2O$, which happens to be plaster of paris. It is the hardening of this plaster of paris and not the cement paste that causes stiffening in a false set. This can be pulverized with a little spadework leaving the concrete to harden virtually undamaged in the usual time.

Flash set is an irreversible action and consequently a more serious condition. In this case, the gypsum fails to retard the concrete adequately; and the concrete hardens almost instantaneously, giving off a great amount of heat. Those who have experienced a flash set liken the resulting heat to that given off by a blazing oven. There is no alternative in the event of a flash set but to break up the resulting concrete—which can often be expensive.

(MORE)

Before pouring, dampen the subgrade so that it will not absorb water from the mix and cause cracks to form at top surface.

TABLE 3: EFFECT OF TEMPERATURE OF MATERIALS ON INITIAL CONCRETE TEMPERATURE

Heat Capacity of the Materials:

Cement (6 sacks per cu. yd.)	= 564 lb. × 0.20*	=	113 BTU per deg. F.
Water (W/C = 0.50)	= 282 lb. × 1.00	=	282 BTU per deg. F.
Total aggregate	=3100 lb. × 0.20	=	620 BTU per deg. F.
	Total Heat Capacity of the Concrete	=	1015 BTU per deg. F.

Temperature Change of Materials to Change Concrete Temperature 1°F.:

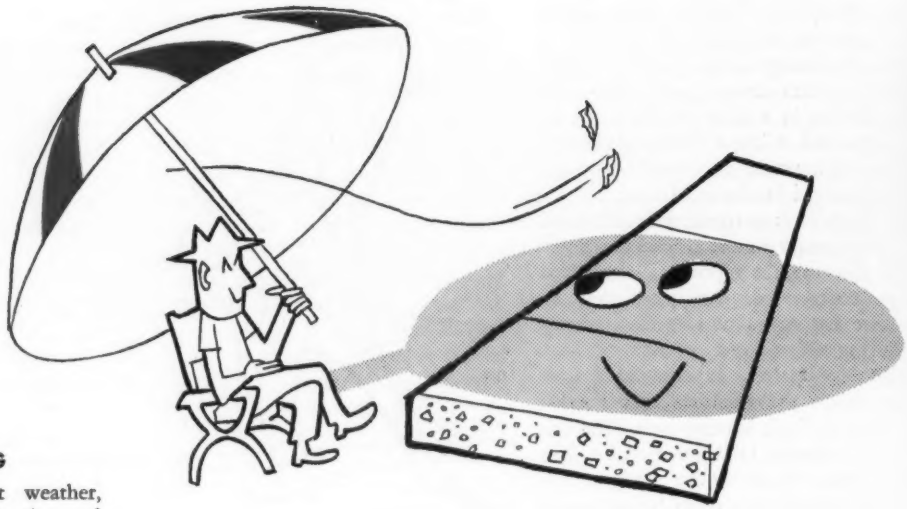
$$\text{Cement} - \text{Temperature Change} = 1.0 \times \frac{1015}{113} = 9.0°\text{F.}$$

$$\text{Water} - \text{Temperature Change} = 1.0 \times \frac{1015}{282} = 3.6°\text{F.}$$

$$\text{Aggregate} - \text{Temperature Change} = 1.0 \times \frac{1015}{620} = 1.6°\text{F.}$$

*Specific heat.

TABLE 3. Each ingredient in a concrete mix contributes to the heat of the mixture according to its initial temperature, its specific heat and the amount of the material that is used. Cement and aggregate have a low specific heat, about one-fifth that of water. The heat contribution of cement is small compared to that of the water and the aggregate. This is indicated in the above table in which calculations are made for the heat capacities of the various ingredients of a concrete mix and for the relative effect of each on the temperature of the mix. For a mix containing 6 sacks of cement, 282 pounds of water and 3100 pounds of aggregate per cubic yard, the relative heat capacities of the individual ingredients are 11 percent for the cement, 28 percent for the water, and 61 percent for the aggregate. To lower the temperature of this concrete mix 1 degree F. it would be necessary to lower the temperature of the cement 9 degrees F., or of the water 3.6 degrees F., or of the aggregate 1.6 degrees F.



After pouring, when the weather is particularly hot, shade the concrete from the direct rays of the sun until it hardens sufficiently for finishing.

AFTER POURING

During particularly hot weather, concreting is often done in the cool of the night. It is best not to get too ambitious in regard to the amount of concrete to be placed at any given time. Keep pours small so that finishing can be accomplished rapidly. This will prevent the formation of cold joints.

If work is being done in exposed locations, a windbreak and shading of the concrete are highly desirable while waiting for the concrete to harden sufficiently for finishing. Untimely finishing is an especially bad practice in the summer since it heightens the likelihood of dusting and cracking.

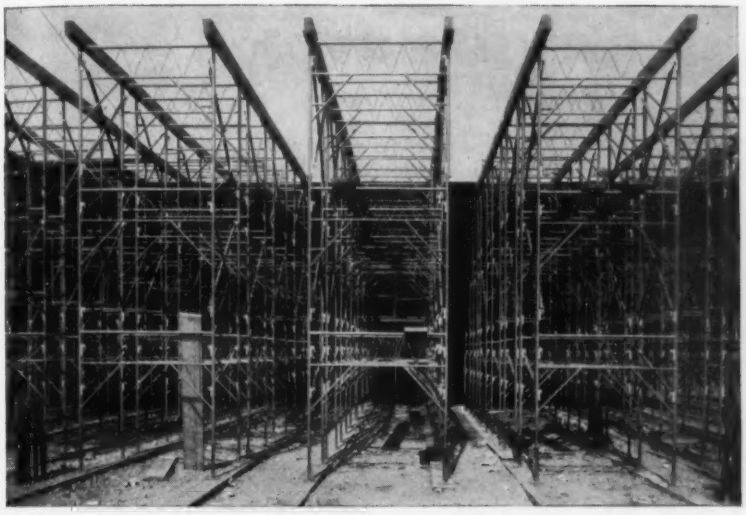
Curing must be started as soon as possible after finishing. If it is delayed the exposed surface will dry and shrink faster than the bulk of the concrete and result in crazing. Be sure to keep concrete damp during the entire curing period. A comprehensive article on the various current curing techniques can be found elsewhere in this issue.

Summer concreting is largely a matter of careful planning and conscientious workmanship. If the simple rules pointed out in this article are followed, no trouble should be encountered. END

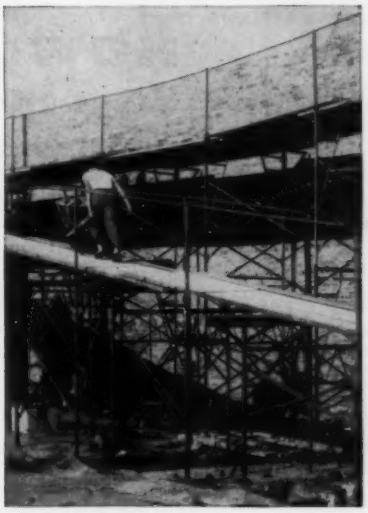
During the entire curing period, be sure to keep concrete damp with suitable curing compound, moisture-retaining covers, fog spray, or soaked covers.

Readers who would like to have additional information on the subject discussed in the foregoing article may request it by filling out one of the reader service cards in this issue.

Scaffolding Methods . . . by Patent Scaffolding Co.

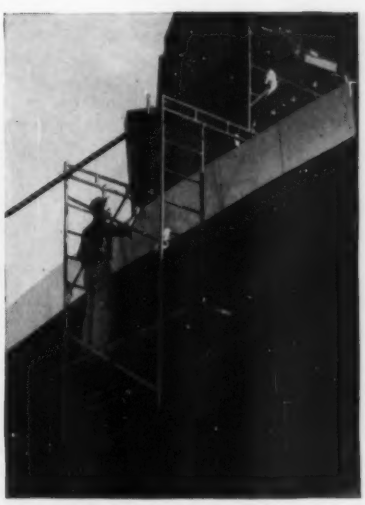


PREFAB SHORING FOR 12" SLAB—On a new 150' x 350', two-story building for Polaroid Corp., Waltham, Mass., general contractor Aberthaw Const. Co. needed support for a 12" slab. 4000 "Trouble Saver"® Shoring frames assembled in rows 3' and 3'6" apart easily provided for it. Job supt., Al Parsons, Jr.. says "We found these shoring frames, braces and components very easy to handle. We know that this type of shoring goes up faster, cuts costs and gives us maximum access to the base slab for other work".

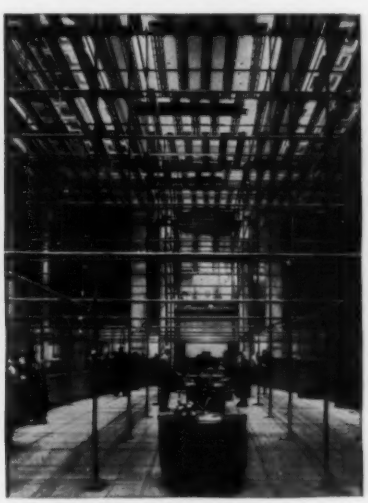


DOUBLE-DUTY—Both the wheeling ramp and the mason's platform in back are made from prefab sections of "Trouble Saver Scaffolding. Varying-height frames and adjustable legs achieve the slope. Terminal Construction Co., Woodridge, N. J., general contractor.

GLASS SETTING RIG—A special rig, developed by Pittsburgh Plate Glass Co., with 700 "Trouble Saver" Scaffolding frames for working platforms, places 8' x 11' glass panes for Conn. Gen. Life Ins. Co. new building, Hartford. Eight rubber cups grip panes, overhead crane lifts to position. Turner Construction Co., general contractor.



ROLLING SCAFFOLD—Unusual set-up is made of two 5'-wide, counter-weighed "Trouble Saver" Scaffolding frames on casters. 12'-trusses are attached and ladder frames hang below. Sidewall brackets make two-level platforms. Scaffold rolls around roof perimeter of new Dallas Memorial Auditorium. R. P. Farnsworth & Co., gen. contr.



BANKING AS USUAL—Smoke damage due to fire made a wash and paint job necessary at the Marshall and Isley Bank, Milwaukee. Painting contractor, Carl L. Ruhland, used "TubeLox"® Scaffolding with Featherweight Stages to provide working platforms for ceiling and high wall work above and to permit banking traffic as usual below.

To help you with your scaffolding and concrete shoring methods, PS offers a complete nation-wide engineering service available to you locally. See the Yellow Pages in your 'phone directory for the nearest Patent Scaffolding office or representative that sells and rents "Gold Medal" Scaffolds.

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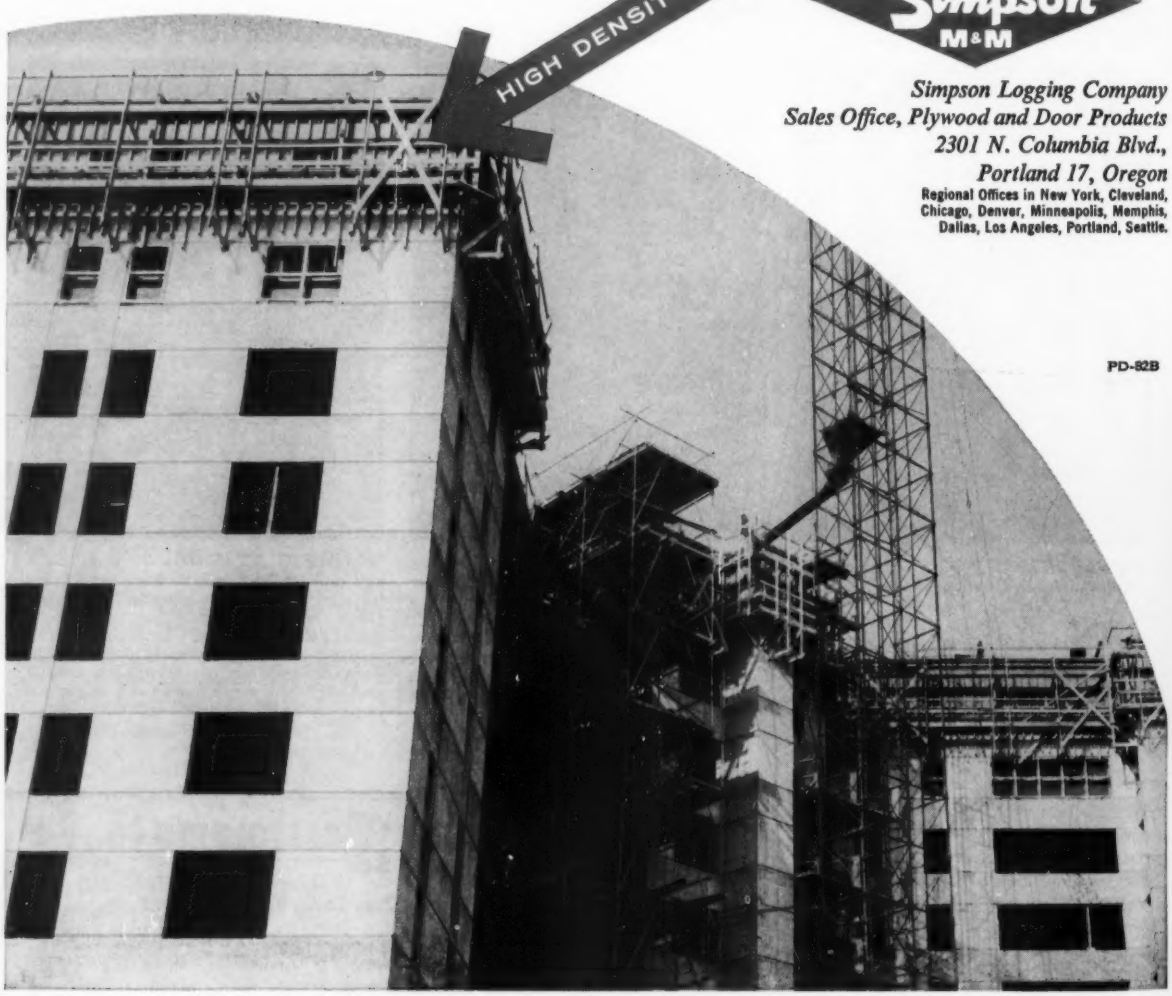

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Some hints on . . .

CASTING TEST CYLINDERS

A few dos and don'ts not always found in the rule books

FILE: TESTING

THIS IS NOT going to be one more review of the step-by-step procedure of casting test cylinders. That procedure was clearly described in the article "Standard Procedure for Making Concrete Cylinders for Strength Test" in the June, 1957, issue of CONCRETE CONSTRUCTION. Rather, our purpose here is to clarify some matters which are present by inference only in the A.S.T.M. specifications or which are sometimes misunderstood.

Perhaps consideration should first be given to the reason for casting test cylinders. Contrary to the thought of many, cylinders are not ordinarily made to determine concrete strength in structures or pavements. Cylinders are cast to verify the *potential* strength of the concrete being used. In other words, this is a method of checking the quality of work done before actual placing begins. If the cylinders indicate that the concrete was capable of developing the required strength but subsequent developments prove that it did not, then the trouble spot can usually be narrowed down to the handling of the concrete after its delivery to the job site.

If you wish to know the strength of the concrete in place, then an additional three cylinders should be cast. These extra cylinders are handled in exactly the same manner as the concrete on the job and the other three

Principal Sources of Strength Variation

Variations in the properties of concrete

Changes in water-cement ratio:
- Poor control of water content
- Excessive variation of moisture in aggregate
- Variations in water requirement:
  - Aggregate grading
  - Nonuniform materials

Variations in characteristics and proportions of ingredients:
- Aggregates
- Cement
- Pozzolans
- Admixtures

Variations in temperature and curing

Discrepancies in testing methods

Inconsistent sampling procedures

Nonuniform fabrication techniques:
- Amount of compaction
- Excessive handling of sample
- Care of fresh cylinders

Change in curing:
- Temperature variation
- Variable moisture

Poor testing procedures:
- Cylinder capping
- Compression tests

cylinders are made and cured in conformance with the A.S.T.M. specifications.

A recently released recommended practice of the Concrete Industry Board, Inc., contains some principles which are especially pertinent to this discussion. For one thing, it points out that the owner or architect should be charged with the responsibility for choosing and paying a qualified testing laboratory. Also, it is suggested that the scope of the laboratory's activities should be clearly defined.

One man should be appointed to cast all the cylinders. The only way to achieve uniformity and to get cylinders which truly reflect the quality of the concrete is to instruct a single individual in the proper procedure and make him responsible for carrying out this work.

Concrete should be sampled when the mixing drum is one-half discharged. Under no circumstances should it be taken from the first or last parts of the load. Do not use concrete which has been used for a slump test. Set aside a reasonably clean work area which is not subject to heavy traffic. Have ready before concreting commences all the needed apparatus (including an insulated storage box). Make sure that your equipment is free from foreign materials which might cause incorrect results.

It is recommended that steel cylinder forms be used since cardboard forms result in a 10-20 per cent lower strength reading. This is caused by water absorption by the form (which takes place even in waterproof units). The subsequent expansion causes striations on the sides of the cylinder that result in earlier failure of the specimen.

Don't rod cylinders with a reinforcing bar, a special bar is made for this purpose. This rule is especially important when working with stiff mixes. Use of a rebar will defeat the purpose of rodding by disrupting the compaction of the concrete.

A record should be kept of pertinent data on the cylinder castings. When something goes wrong on a job, it is usually not discovered until some time after the concrete is poured. During this time a great many of the details necessary to properly assess the cause of failure are likely to have been forgotten. Notes on the following facts should be jotted in the record book and keyed to the appropriate cylinders: (1) date and location of job; (2) individual who cast cylinders; (3) temperature and humidity; (4) number of days specimens were field cured; (5) portion of structure in which concrete was used; (6) slump of concrete; and (7) information concerning any other occurrences which might adversely affect the concrete (e.g., a delay in discharging ready-mix on a hot day).

Even when properly cast and cured, test cylinders can vary surprisingly. In a test, the same six-sack mix concrete was delivered to several contractors who cast cylinders from it. The results from these specimens ranged from 1800 psi to 4200 psi. On another occasion, identical cylinders were delivered to three commercial testing laboratories. Their reports of strengths showed a range of 27 per cent (although results varied only 9 per cent in any one laboratory).

Concrete is a complex material whose strength is affected by variations in any of its several ingredients and by environmental factors. Cylinders—correctly made, cured and broken—give a reasonably accurate estimation of the potential of concrete as delivered to the job site. If extra cylinders are cast to determine the strength of concrete in place, it would be wise to augment these findings with one or more of the non-destructive tests available. The only truly definitive results can be obtained through testing of cores taken from the pavement or structure.

Of the various aspects of concrete construction, testing is one of the least developed. However, work has been intensified on this phase in recent years and such developments as the hammer rebound test and the Kelly ball give promise of improvements that will take much of the uncertainties out of concrete testing. END

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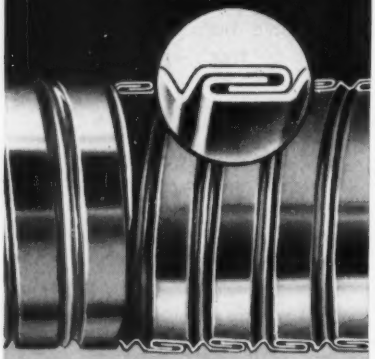

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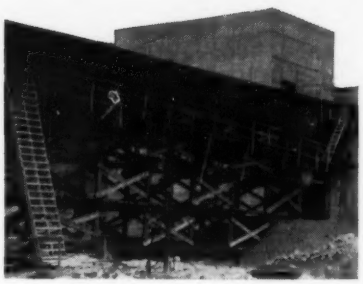
concrete construction news

New Record-Breaking Prestressed Span

Construction is now under way on the longest prestressed span in the United States. It is the 216-foot hollow box girder access bridge connecting two buildings at the Washington Aqueduct, Washington, D. C. This cast-in-place, post-tensioned girder displaces the former record holder—the 160-foot span of the Walnut Lane Bridge, Philadelphia, Pennsylvania. The Walnut Lane Bridge, first prestressed bridge in the United States, had held sway as the longest span since its completion in 1951.

A gigantic concrete counterweight is being cast at each end of the access bridge span. The big girder is 7 feet deep at midspan and 12 feet deep at its ends. It provides a roadway width of almost 16 feet. The box girder is being cast in several sections—first, the 8-to-10-inch base slab; then, the 16-inch side walls; and finally, the 8-to-10-inch top slab.

As American contractors and engineers become increasingly familiar with prestressed concrete, its scope of application is widened. And when it comes to the big jobs, post-tensioned, cast-in-place girders have proved most economical—witness the heavily loaded railroad spans at Colorado Springs reported in CONCRETE CONSTRUCTION, March, 1958, as well as this record-breaking span.



Engineers for the Washington Aqueduct bridge were Corps of Engineers, U. S. Army, Washington District. Consulting engineers were Black and Veach, Kansas City, Missouri. General contractor is the James McHugh Construction Company, Chicago, Illinois. Prestressing design and sub-contractor is Prestressing, Incorporated, San Antonio, Texas.

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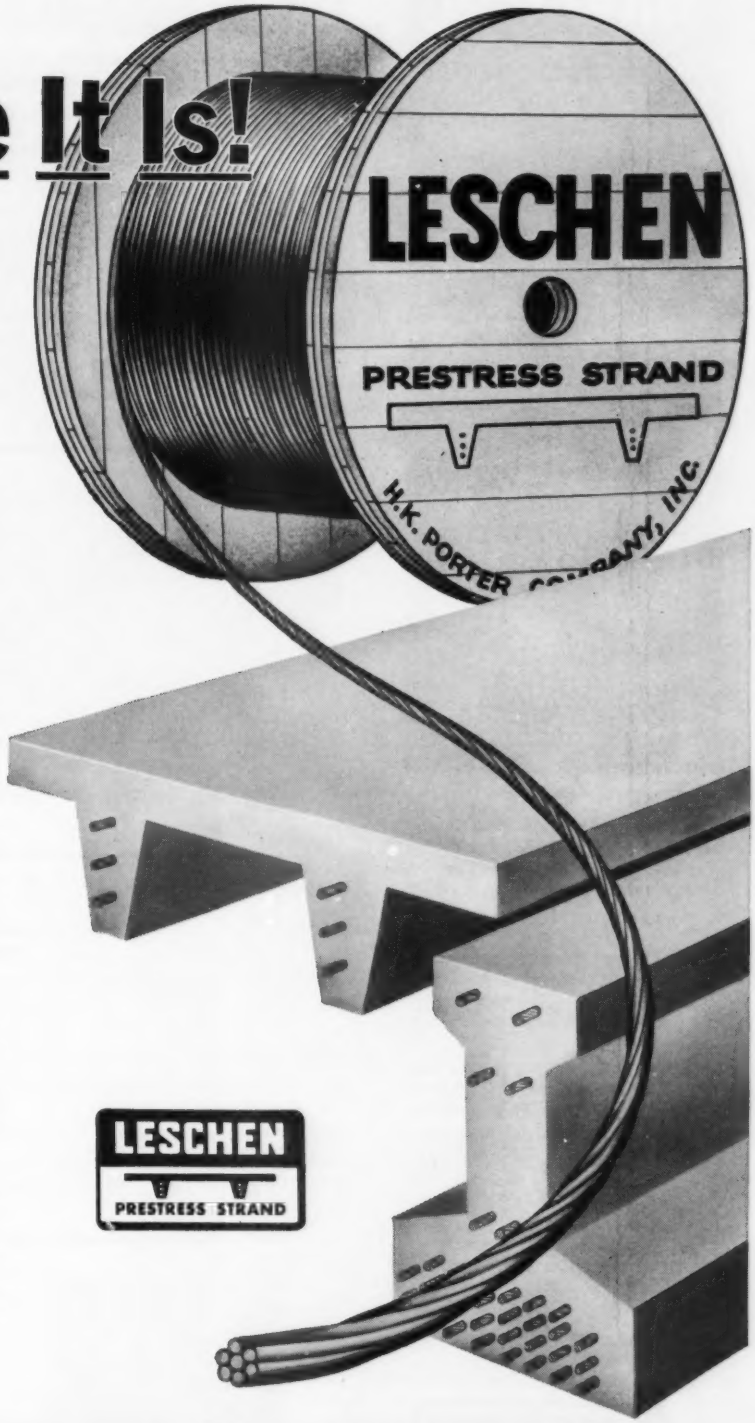

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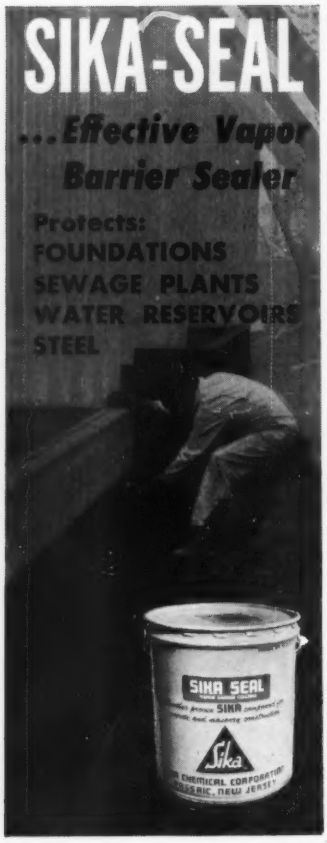

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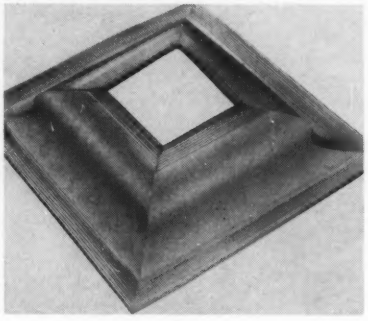
equipment tools

Additional free information concerning these items may be obtained by mailing the reader service cards located between pages 16 and 17.

Sump Pump

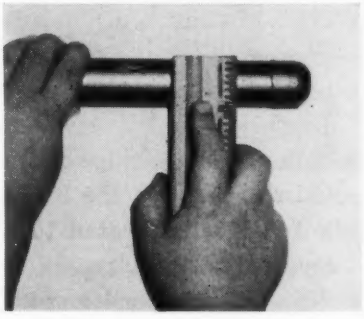
A new, compact air sump pump, designed for low head pumping operations of contractors, drains 200 gallons a minute from tanks, excavations, ditches, sewers, basements and manholes. Non-clogging design makes the pump ideal for removing clean or dirty water, sewage, oil, sludge, and other fluids. The pump weighs 35¾ pounds. **Thor Power Tool Company, Prudential Plaza, Chicago 1, Ill.**

Plastic Waterstops



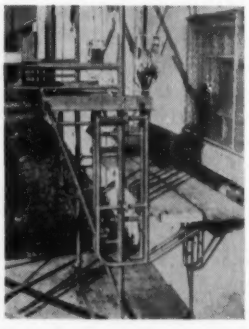
Vinyl plastic waterstops surround concrete pads on which rest magnetic accelerators in a new nuclear facility. Glass wool insulation was placed above and below the waterstop in the expansion joint and sealed with an asphalt rubber sealer. Thus each pad with its magnetic accelerator was protected against water seepage and movement due to expansion and contraction of surrounding concrete. **Water Seals, Inc., 9 South Clinton Street, Chicago, Ill.**

Vibrator Head



A ⅞-inch diameter vibrator head is run by a 5/16-inch flexible shaft connected to the manufacturer's standard midget vibrator. This small vibrator head is 10 inches long and operates at 12,000 vibrations per minute. It is particularly recommended for the extremely narrow forms encountered in prestressing operations. **Stow Manufacturing Company, 354 Shear Street, Binghamton, New York.**

Elevating Bracket



This device, used with 5-inch wide sectional steel scaffolding, provides two platforms, one for men and one for materials. Correct working heights are obtained by means of a hoisting winch. A safety latch prevents scaffold from falling below next lower horizontal member in the event of mechanical failure while raising or using scaffold. **Patent Scaffolding Company, Inc., 38-21 12th Street, Long Island City 1, New York.**

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Symons High Strength Panel has steel cross members on 12" centers. Its weight averages just 5 pounds per square foot.

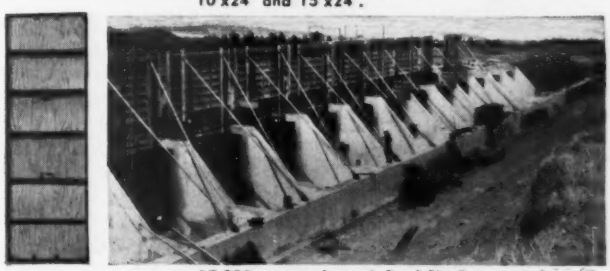
Wide Panel

Symons Wide Panel Forms have steel struts and 2x4 cross members to strengthen the panel and minimize deflection when subjected to heavy pressure. These forms are used in gang forming. They have tie holes in the steel struts which allow the insertion and removal of special ties when the panels are ganged. Built in 6′ and 8′ lengths and 30″, 36″, 42″ and 48″ widths.

Pouring a 2,400 foot retaining wall with Symons Wide Panel Forms made up in gang sections of 10′x24′ and 15′x24′.

Steel-Ply

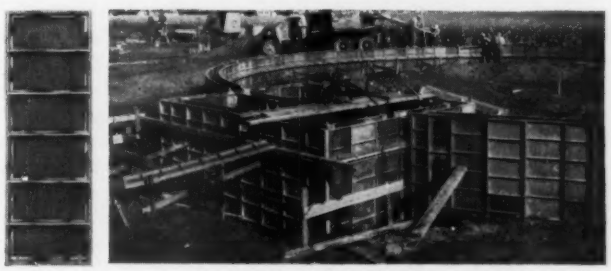
Designed for durability and long-life. The initial cost of these forms is higher than Symons Wood-Ply Forms. However, this first cost is more than offset by the many reuses possible with these panels. They are easily erected and stripped with the 3 basic pieces of the Symons System—connecting bolt, panel tie and wedge.



37,000 square feet of Steel-Ply Forms used on the Air Force Academy, Colorado Springs, Colorado.

Mag-Ply

Symons Mag-Ply Forms are the lightest forms available . . . weight averages about 3½ pounds per square foot. The frames of durable, rust-proof magnesium completely encase the plywood, will last indefinitely and will not swell or shrink. 2½" thickness of frames means more panels per truck load, less space for stacking and storage.



Light and efficient Mag-Ply Forms are readily adaptable for circular, battered and cut-up walls.

Only 3 Hardware Pieces

Symons Forms available on a Rental Basis.
Rentals can apply to purchase price.

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more SAVINGS from SYMONS

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STEEL STAKES by *dee*

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SLASH COSTS

Set up 10 times faster

Strip 20 times faster

Get 100 or more reuses

Always a Positive Nailing Position Regardless of Axial Rotation

12 nail holes 1" o.c. spirally arranged

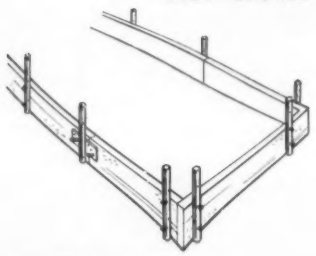
24 nail entry points

Always drives straight in any type of ground

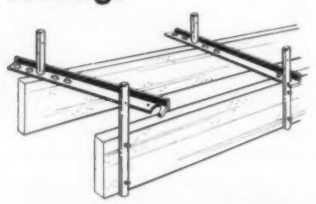
No material clean-up

SAVE TIME AND MATERIAL

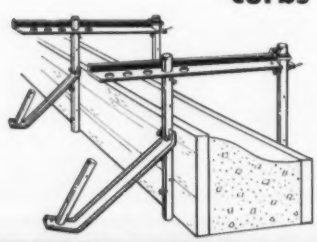
flat work



footings



curbs



dee CONCRETE PRODUCTS CO.

(Licensed Manufacturer)

670 North Michigan Avenue
Chicago 11, Illinois
MOhawk 4-3664

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questions and answers

QUESTION: What would be the most likely cause of a sudden onset of excessive bleeding in a multi-story building project involving lightweight ready-mixed concrete?

ANSWER: Excessive handling between the truck mixer and the form is a likely possibility. It is preferable, wherever possible, to handle such concrete by means of cranes and buckets rather than by any method that involves several transfer points. The objectionable bleeding could probably be eliminated or substantially reduced by the addition of 2 percent of calcium chloride to the lightweight concrete.

QUESTION: How much additional cost is incurred in reinforcing the concrete used in home construction?

ANSWER: Figures published by the American Steel and Wire Division of United States Steel Corporation indicate that the addition to the cost of the average house would be approximately $35, or less than one cent a day on the average mortgage. These figures presuppose the use of welded wire fabric reinforcement, at a cost addition of approximately 10 percent of the cost of the concrete itself.

QUESTION: Are any statistics available on the methods currently used in the payment of construction superintendents?

ANSWER: A survey recently conducted by *Construction Equipment* magazine turned up these facts: Two out of three contractors pay their job superintendents a salary and a bonus; more than half of the companies surveyed base such bonuses on year-end company profits; other methods of determining bonus include arbitrary estimates of the individual's worth (18 percent), net job profit (18 percent), and gross job profit (9 percent). The survey also disclosed that the average superintendent or project manager earns $10,400 per year. Only 15 percent of the construction firms studied reported superintendent earnings of $15,000 or more per year.

QUESTION: How much gradient should be provided away from slab-on-ground residences?

ANSWER: The Building Research Advisory Board recommends that finished grades should slope downward away from structures having slab-on-ground construction a minimum of 12 inches for the distance of 25 feet in all directions (in other words a 4 percent slope). Where property lines, retaining walls, or other obstructions limit the distance from the structure to less than 25 feet, no less than 4 percent slope should be provided.

QUESTION: In pavement work why is there more emphasis on flexural strength than on compressive strength?

ANSWER: Pavement concrete actually functions like a wide beam. During the day it tends to hump up at the center as the temperature of the top surface increases. Since the dead weight of the slab itself, as well as the loads imposed by traffic, have a tendency to bend the slab back into a horizontal plane, bending or flexural stresses are inevitably created. This whole cycle is reversed during the night hours when the top surface of the concrete slab often drops to a lower temperature than the surface adjacent to the sub-grade, causing the slab to curl upward at its edges. Obviously during most of its life the stresses which a concrete pavement must withstand are more truly bending stresses than pure compressive stresses.

QUESTION: What is the probable significance of a concrete driveway that remains wet after others in the same vicinity dry out following a rain?

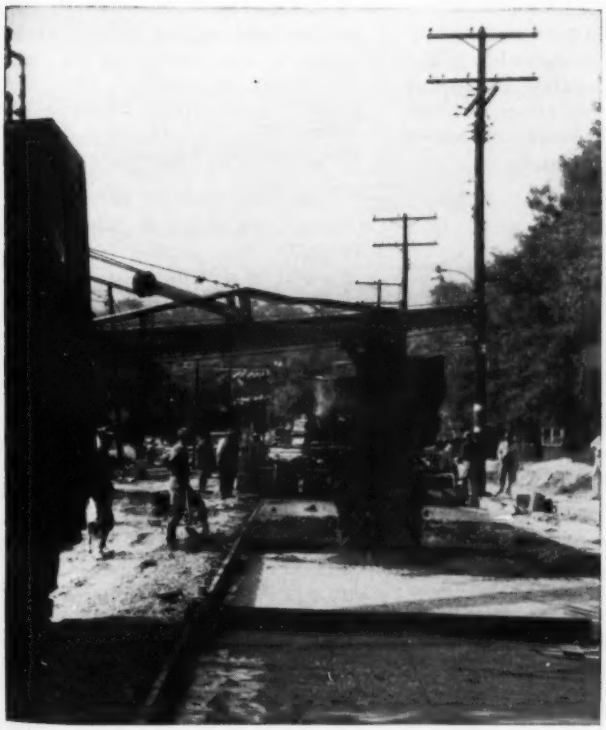
ANSWER: When this condition is encountered, it generally means that the water has gone down through the slab. Since this is an almost certain prelude to winter time difficulties, it is desirable to take remedial steps, such as applying a silicone product or treating the slab with a 50-50 mixture of linseed oil and kerosene.

Concrete products cure faster and handle better despite temperature

Block, panel, and pipe products cure days faster, even with chilly night temperatures, when Columbia Calcium Chloride has been added to the mix. You can expect normal three-day strengths at the 24-hour point. It's safe to cut pre-steam holding time, steaming and soaking periods. Breakage and chipping are sharply reduced during early handling, too. With this faster production, you can trim inventory tie-up and still meet construction timetables. An added benefit: Columbia Calcium Chloride works with equal effectiveness in concrete made from normal, air entrained, and high early cements.

COLUMBIA CALCIUM CHLORIDE

saves days of set time and produces stronger concrete



Ready mix gets faster initial and final set even on chilly nights

Contractors will soon be fighting time-tight schedules, looking for areas where valuable days can be saved. That's where you, and Columbia Calcium Chloride, come in. Concrete treated with this set-accelerating chemical meets early strength specs *a minimum of 50% faster* at 72 hours than untreated ready mix. Finishers move on and off the job days ahead of schedule, forms can be pulled and moved to other pours with no lost time. And Columbia Calcium Chloride presents no handling problem . . . can be added equally well at your plant or on the job site.

WRITE TODAY FOR MORE INFORMATION . . . PLEASE SAY WHETHER INTERESTED IN READY MIX OR IN CONCRETE PRODUCTS

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

A Subsidiary of Pittsburgh Plate Glass Company

DISTRICT OFFICES: Cincinnati, Charlotte, Chicago, Cleveland, Boston, New York, St. Louis, Minneapolis, New Orleans, Dallas, Houston, Pittsburgh, Philadelphia, San Francisco IN CANADA: Standard Chemical Limited

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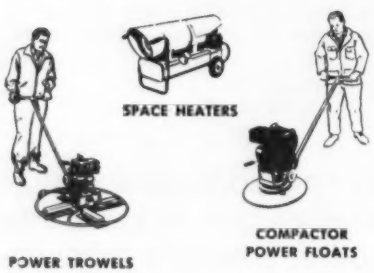
2400 TIMES A MINUTE

Kelley POWER TAMPER

Illustrated—
Model 18KT

Everywhere this season the Kelley Power Tamper is saving time and money for contractors. A massive eccentric-loaded rotor bangs this machine up and down with terrific force, compacting soil or blacktop into a dense, interlocked mass. Ruggedly-built yet easy to operate, the Kelley Power Tamper propels itself up to 60 feet per minute. It's ready-to-go. Two models to choose from: 18" wide shoe and 36" wide shoe. Fill out coupon now for more information.



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POWER FLOATS

The Kelley Power Tamper is the perfect tool for packing down earth backfill to maximum density next to foundations, on road-widening jobs, around culverts and in pipeline trenches. Also for finishing blacktop driveways.

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literature

For additional free information mail cards facing page 16.

Plywood. A folder describes Simpson high density overlaid plywood and explains how it cuts concrete finishing costs, gives more reuses, strips cleanly and quickly and cuts form maintenance. This plywood is exterior grade Douglas fir plywood with sheets of Kimpreg, a cellulose fiber impregnated with phenolic resin, bonded to the face veneers under heat and pressure, giving tough, smooth surfaces. Simpson Logging Company, 1010 White Building, Seattle 1, Wash.

Soil stabilizer film. "One Third Mile Per Hour" is the title of a new 16 mm. sound film portraying construction of a soil cement roadway with a P & H Single Pass soil stabilizer. Designed as a public service feature, the new full color film was taken during actual road building operations in Michigan and tells a complete job story in 15 minutes. It is of interest to road builders and general contractors as well as to civic groups and city, state and county organizations. Soil Stabilizer Division, Harnischfeger Corporation, 4400 West National Avenue, Milwaukee 46, Wisconsin.

Film on horizontal shoring. An excellent understanding of current methods of applying Spanall, a new all-metal horizontal shoring for beam and slab concrete floor forms, may be obtained from a 15-minute color and sound film, "Span and Save." The film depicts stripping methods as well as installation methods at various building sites. It is available without cost for group showings to building and construction contractors, architects, societies, schools and colleges. Spanall of the Americas, Inc., 787 United Nations Plaza, New York 17, N.Y.

Vibrating screens. Grizzly bar screens, concentric action screens, screening feeders, unbalanced pulley screens and pulsating magnet screens are pictured in a booklet, No. 44791. Specifications for all models are given, along with explanations of their specific uses. Syntron Company, Box 220, Homer City, Pa.

Concrete carts. Bulletin 103-A describes several models of concrete carts which are said to handle 30 percent more load with half the effort. They provide perfect balance when loaded, are lightweight. Rocker dump types or rocker attachments are available for handling dry concrete. Wheels have depressed hubs and 4-inch roller bearings. They are fitted with 4-ply pneumatic tires. Gar-Bro Manufacturing Company, 2415 East Washington Boulevard, Los Angeles 21, California.

Steel construction stakes and accessories. This new folder contains information on the complete line of DEE steel nail stakes and accessories for staking in all types of construction. It is of special interest to the concrete and general contractor for his flat work, footings, curbs, bracing and screeding. It introduces a new line of stake pullers, a complete line of screed bar supports and shows the improvements made in the standard line of time and material savings steel stakes and accessories. DEE Concrete Products Co., 670 N. Michigan Ave., Chicago 11, Illinois.

Building products. A catalog contains pictures and specifications of this manufacturer's line of steel and aluminum windows, steel door frames and miscellaneous building products. The steel window buck for installing basement windows in poured concrete foundations is included, with a drawing and a photograph illustrating its installation. Catalog B-1254, Kewanee Manufacturing Company, Kewanee, Illinois.

Estimating guide. An illustrated brochure covers a full line of products for treatment of concrete floors and wood floors, as well as admixtures for concrete and mortar, and water-proofing and damp-proofing compounds. For each product there is information on use, quantities required, method of application and cost. From this information specific products for any building construction or maintenance need can be selected and information is provided to aid in installation. Building Products Division, L. Sonneborn Sons, Inc., 404 Fourth Avenue, New York 16, New York.

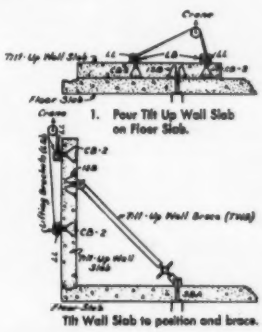
Precast Concrete Components Lifted and Placed With Richmond Lifting Inserts

Precast wall slab being tilted into place by means of Richmond Lifting Inserts and Lifting Brackets.

Certified laboratory tests assure proper strength rating for efficient design and performance in concrete at usable strength

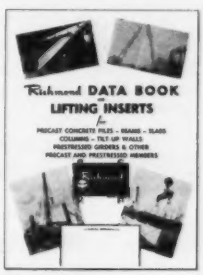
Richmond has developed and tested a complete line of Lifting Inserts and accessories for handling and placing of precast concrete wall slabs, columns, beams, girders, piles, etc.

No matter what type of precast units are involved, Richmond can supply exactly the right type of insert for the specific job.


Crane
Tilt-Up Wall Slab
Floor Slab
1. Pour Tilt Up Wall Slab on Floor Slab.
Tilt-Up Wall Brace (THB)
Tilt Wall Slab to position and brace.

These units are designed with adequate extra strength and for simple operation in lifting and bracing precast concrete components.

Send for your copy of the Richmond Data Book on Lifting Inserts giving complete technical data, dimensions, working loads and ultimate strengths in various strengths of concrete. At the same time ask for your copy of the latest Richmond Handbook showing the complete line of form tying anchorage and accessory devices for concrete construction backed by 47 years in this field.



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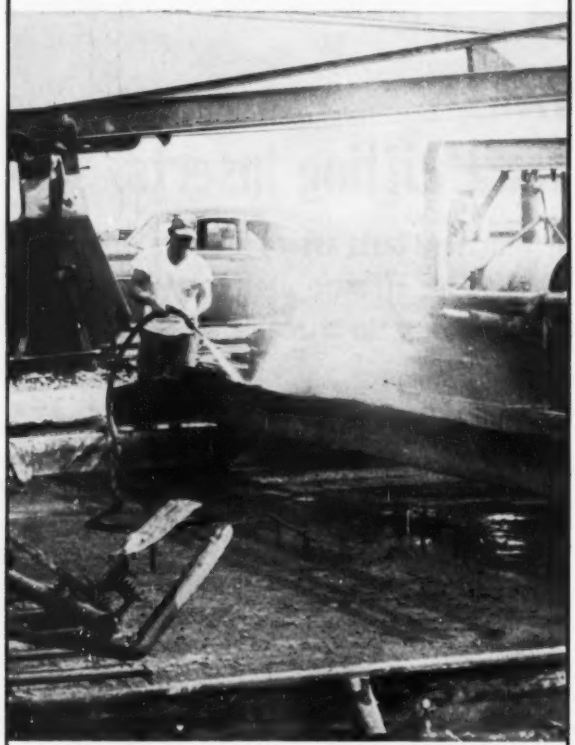
TRUCKS • PAVING MACHINERY
MIXERS • EARTH MOVERS

CLEANS RIGHT DOWN TO THE PAINT!



- ELIMINATES CHIPPING AND SCRAPING
- EXPOSES ALL LUBRICATION FITTINGS
- KEEPS EQUIPMENT LOOKING NEW

This compact, portable washdown pump is powered by a four cycle gasoline engine. Can be used anywhere. Self-priming, no check valves. Delivery to 40 gpm—pressures to 150 psi.

WRITE FOR FREE ILLUSTRATED BOOKLET ON MODEL 6600 WASHDOWN PUMPS.

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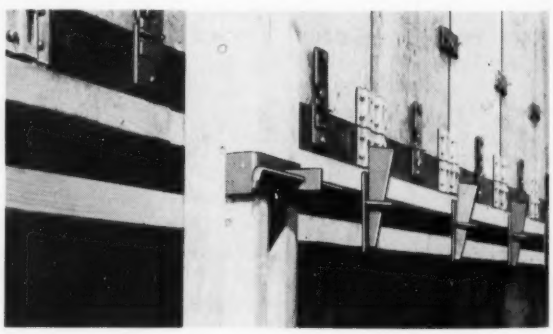
equipment and tools

For more information mail cards facing page 16.

Dispersing Agent

Over 100,000 cubic yards of concrete containing a new concrete water reducing agent that is said to give maximum water reduction, higher strengths and better cement dispersion in all types of mixes, was recently placed at the Buckley Air Field project in Denver with completely satisfactory results reported. In spite of 95-degree temperatures, concrete temperatures of 88 degrees and wind velocities of 40 miles per hour, this 11-to-13-inch concrete placement showed negligible shrinkage cracks after 8 weeks. **Autolene Lubricants Company, 1331 West Evans Avenue, Denver, Colo.**



Stack Plate Hardware

Simplex standard forms may be adapted to heavier commercial application by the use of this stack plate hardware in poured walls or foundations up to 10 feet. Heavy gauge steel plates are mounted in sets. Both plates are precision made to assure perfect fit of the locking wedge and great rigidity. To secure the forms and permit running the wires between the panels for greater strength, standard Simplex locking levers are mounted vertically between the stacked panels. **Simplex Forms System, Inc., 5605 Industrial Avenue, Rockford, Illinois.**

letters

Preventing Failures

Sir:

Considerable fervor has been stirred up recently in Rio de Janeiro, Brazil, over the collapse of two buildings in the downtown section. It took an accident, fatal to nine persons, to provide the Engineering Club with an opportunity to press the City Council for a law requiring constructors not only to guarantee the safety of new erections, but also to provide complete plans for the protection of neighboring buildings.

One of these failures was an ancient relic, already abandoned and condemned. The other, a twelve year old ten-story structure, came down over a protracted period, allegedly because no bulkhead was erected between it and an adjacent excavation for new construction. Daily building inspection before the collapse declared it to be safe, yet it collapsed.

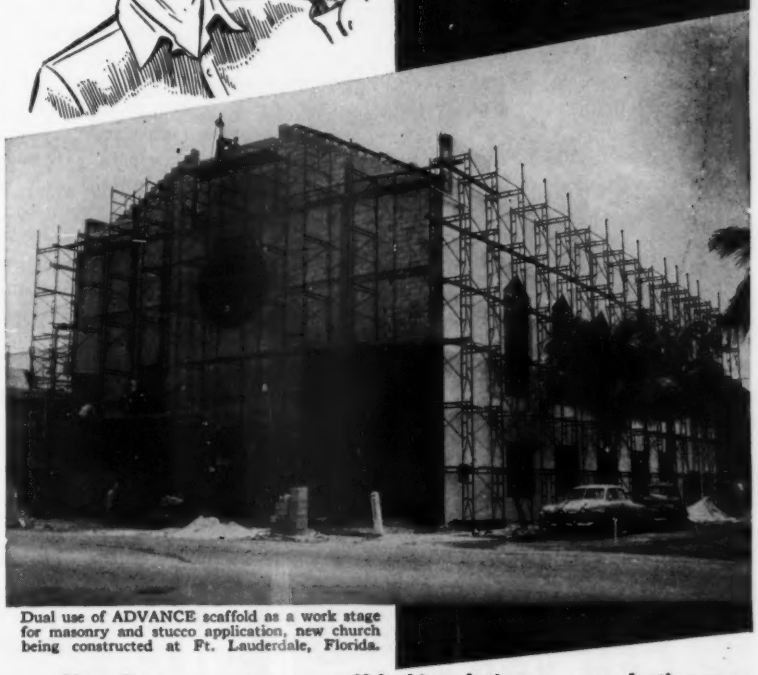
This is not a letter of recrimination; it is merely a conjecture regarding what might be done to prevent future failures. Why do these things happen? Can they be prevented? Of course! The Rio case was a foundation failure. In Britain two years ago a new, tall, narrow building cost more to underpin and salvage than the combined costs of construction, and failure was prevented by the narrowest of margins.

A large North American industrial firm, building a very expensive pilot plant on a Caribbean hillside, excavated the topsoil to form a bench for construction. The hilltop slid into the cut. The home office, with due concern, hired a couple of soils and foundation consultants, who, after a thorough investigation of the hillside, devised a set of corrective measures, and construction went on in safety: near failure prevented. In Washington, D. C., it was desired to build a road underpass beside an existing building on an embankment. Laboratory tests on soil samples from the site showed conclusively that the adjoining structure would slide into the excavation for the underpass if it were to be opened over the full length of the cut at one time. Armed with this knowledge and some additional facts, it was possible to complete the construction in absolute safety: no sign

here's SCAFFOLD. . . . .

that eyes right

buys right, too!



Dual use of ADVANCE scaffold as a work stage for masonry and stucco application, new church being constructed at Ft. Lauderdale, Florida.

Clean lines . . . smart new self-locking design . . . ever-lasting usefulness — these are just some of the reasons why more and more building construction and maintenance jobs, everywhere, are being scaffolded with ADVANCE.

To general contractors and building tradesmen, ADVANCE scaffold affords a *plus value* for speed of erection, safety, durability, long life and ease of dismantling. It's specialized equipment that saves time, money and manpower on a wide range of job applications. Little wonder that ADVANCE continues to capture an ever-growing share of the scaffolding market, and that production schedules have been accelerated to keep pace with the spectacular demand.

Field-experienced BEAVER-ADVANCE engineers are readily available to supply you with working plans, bills of material and job estimates —with scaffold stocks for sale or rental available through 68 ADVANCE distributors conveniently situated in principal construction centers throughout the United States.

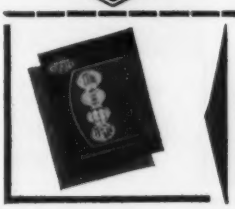
For complete details on the scaffold that will both *eye and buy right* for you, contact your *ADVANCE* dealer, or write direct.

BEAVER ADVANCE

Beaver-Advance

CORPORATION

Ellwood City, Pennsylvania



Send for this descriptive catalog, it's FREE!

BEAVER-ADVANCE CORPORATION., ELLWOOD CITY, PA.

Name.....

Company.....

Address.....

City..... Zone..... State.....

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of failure.

The cheapest form of building insurance known is complete subsurface investigation, not only for safety and legal reasons, but also for economy of design and construction. Granted the surrounding structures should be examined beforehand for cracks and displacements; but nothing can substitute for the taking of good soil samples from adequate depths in strategically placed bore holes; the careful analysis of these in a good laboratory; and the correct interpretation of the ensuing results into intelligence for safety and design.

Most failures adjacent to excavations happen in plastic soil or in places where there is lowering of a high water table. Sometimes the construction hole will go deeper than existing neighboring foundations or piles. These places must be underpinned. C. W. Dunham in "Foundations of Structures" (McGraw-Hill, 1950) gives a dozen typical examples of danger signals, all predicated on a soil profile's being at hand. In his sections on aids for open excavations and on underpinning, he goes through preventive measures. But this is only one of fifty excellent texts on the subject, all competent, all informative, all not used nearly enough.

Curtain-walls, shoring, pile clustering, underpinning, etc. are not always the answer to saving the house next door. In some places plastic flow of a clay-like soil is not the cause, but the subsurface investigation has disclosed granular soil; the bugaboo here is reduction of permeability—to keep the groundwater from flowing out from under the standing structures. If the case is such that cellular walls or cofferdams cannot be erected, then something must be put into the soil itself to act as a dam.

There is an extremely expensive process of chemical solidification in two stages. Water-glass (sodium silicate) in jelly form is compressed into a bore-hole and is followed by calcium chloride with which it reacts in a one way union to form a block. However, this penetrates only to a radius of about eight feet from the boring and has to be repeated in each strategically placed hole. The drilling expense combined with the high price of chemicals makes this a rather costly proposition for reduction of permeability. A Chicago firm says that seepage can be stopped by reducing permeability by gelation, or chemical grouts within the voids of the soil mass, using the soil particles themselves as binder. There is a variety of chemical grouts for each type of condition, and any one of these materials can be injected into the soil and pumped to where it gels to form an impervious mass to stop seepage.

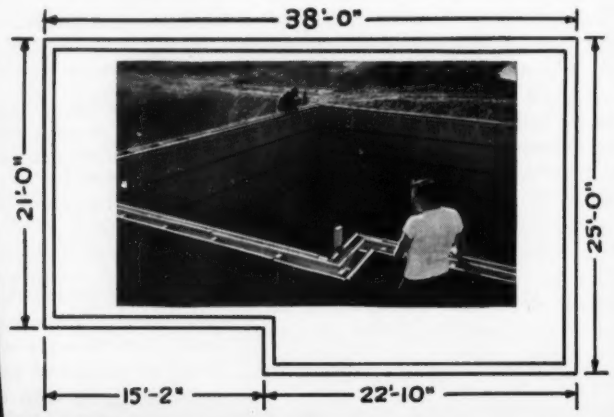
Beyond chemical stabilization, there is the wellpoint system of keeping the excavation dry by pumping it out, but this convenience has a disastrous side effect in that without due precaution it may cause adjacent building failure. J. D. Parsons of Moran, Proctor, Muesser & Rutledge told the 1956 Pittsburgh Convention of ASCE about his new method of recharging the outside neighboring ground with the pumped out water rather than running it to waste. With this "closed" system of continuous pumping he kept the surrounding buildings stable, kept his excavation dry, and did not require the use of a cofferdam or sheeting.

Why do buildings fail when construction work starts next door? For many reasons, but mainly because someone did not order a soils survey and get to the bottom of it!

M. D. MORRIS, *Vice President Testlab Corporation, New York, N.Y.*

CAN YOU MATCH THIS TIME?

ONLY 22 MAN HOURS TO ERECT, POUR AND STRIP THIS TYPICAL FOUNDATION



On-the-job reports from Simplex users indicate genuine enthusiasm for the "world's fastest method of concrete forming." Typical is the case of a contractor* who handled the foundation shown in a mere 22 man hours. Using 4 men, inner and outer forms went up straight and true in 1½ hours . . . pouring took 2½ hours . . . stripping 1½ hours! This man pocketed a neat profit and was ready to tackle another job in short order. How about you? Are you making such fast, money-making progress in your operation?

*Name on request.

- *Free Engineering Service*—Send your specifications for form layout and quotation, plus recommendations of our staff. No obligation in any way.
- *Send for Free Bulletins*—You'll want all the facts. Your request will bring complete literature on Simplex Forms and accessory equipment.
- *Choice Openings*—You can also make a profit selling Simplex. We have openings for dealerships in some areas. Write today for information.

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Simplex FOOT-A-MINUTE forms

SIMPLEX FORMS SYSTEM, INC.
5603 INDUSTRIAL AVE.
ROCKFORD (Loves Park) ILLINOIS

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book reviews

Papers on Soils. *Presented at the Second Pacific Area National Meeting, Los Angeles, California, September 17, 1956, American Society for Testing Materials. ASTM Special Technical Publication No. 206. Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania. 178 pp. Illus. $4.50; to members, $3.60.*

A wide range of testing and research projects on soils is covered in the papers included in this publication. It is one of many issued by the American Society for Testing Materials in connection with its work of promoting knowledge of the properties of materials and developing standard specifications and tests for materials.

Titles of the papers will suggest the information available in the book: "Soil Explorations for Site Selection and Engineering Design"—Woods; "A Generalized Theory of Soil Resistance"—Housel; "A Procedure for Separately Evaluating Friction and Cohesion of Soils by a Consolidated Direct Shear Test"—Palmer, Brown and Yeomans; "Experiences with the Consolidation of Pipe Bedding by Vibration on the San Diego Aqueduct"—Holtz; "The Use of a Vibratory Compactor on Granular Base Courses" — White; "Compaction of Cohesive Soil by Low-Frequency Vibration"—Converse; "Microseismics" —Bernhard; "Experiences with Electrical Resistivity Surveys on Foundation and Subsurface Investigations in Southern California"—Maurseth, Howe and Mitchell; "Tests of Concrete Deadman Anchorages in Sand"—Smith; "Field Tests on Laterally Loaded Piles in Sand and Clay"—Mason; "Strength and Elastic Properties of Compacted Soil-Cement Mixtures"—Felt and Abrams.

1958 Industry Directory. *Published by Associated Equipment Distributors, 30 East Cedar Street, Chicago 11, Illinois. 382 pp. $20.00.*

A reference book for the users of construction equipment, this directory contains company names, addresses, key personnel and phone numbers for over 2,000 firms in the construction equipment industry. It is arranged in four sections: distributors and their branches in the United States and Canada, listed alphabetically by state, showing manufacturers represented; manufacturers listed along with their distribution outlets; products, an alphabetical listing of construction equipment; and trade names, a compilation of product trade names.

Cement and Concrete. *Special Technical Publication No. 205. Published by American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania. 158 pp. Illus. $4.00.*

The eight papers included in this volume were originally presented during the second Pacific Area National Meeting in Los Angeles, September 1956, under the auspices of Committee C-1 on cement and Committee C-9 on concrete and concrete aggregates. Discussions of the papers are included. Basic problems commonly associated with cement are covered as well as topics such as hydrophobic cement not commonly dealt with in technical sessions. The volume is well illustrated and documented with tables of data. Bibliographies are included.

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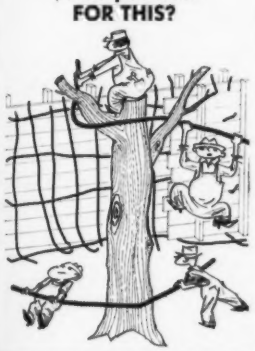

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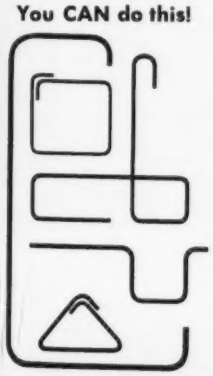

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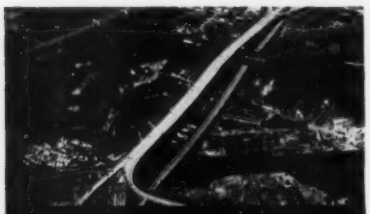

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